**Claims**

1. A method of determining the presence of a toxicant in a test sample, comprising the steps of;
   - exposing a eukaryote that has been transformed with a light emitting $Ca^{2+}$ regulated photoprotein gene to a test sample
   - measuring the light produced by the transformed cell/organism
   - determining whether the amount of light is above or below a defined threshold at the time of exposure.

2. A method as in Claim 1 wherein the eukaryote is a fungi.

3. A method as in Claim 2 wherein the fungi is a filamentous fungi.

4. A method as in Claims 2 or 3 wherein the fungi is of the Aspergillus species.

5. A method as in Claim 1 wherein the eukaryote is a mammalian cell.

6. A method as in Claim 1 wherein the eukaryote is a plant cell.

7. A method as in any of the previous Claims wherein the test sample comprises a toxicant.

8. A method as in any of the previous Claims wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant gene.

9. A method as in any of the previous Claims wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene
- obelin gene
- mnemiopsin gene
- berovin gene

10. A method as in any of the previous Claims wherein the light emitting $Ca^{2+}$ regulated photoprotein gene may be a functional homologue of a gene selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene
- obelin gene
- mnemiopsin gene
- berovin gene

11. A method as in any of the previous Claims wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is an aequorin gene.

12. A method as in any of the previous Claims wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant aequorin gene.

13. A method as in any of the previous Claims wherein the light that is measured is in the form of luminescence.

14. A method as in any of the previous Claims wherein the test sample is added in advance of the application of a stimulus to the test sample.

15. A method as in Claim 14 wherein the stimulus is at least one or more from the group comprising; mechanical perturbation, hypo-osmotic shock, change in external calcium chloride concentration, temperature shock and pH shock.

16. A method as in Claims 14 and 15 wherein the test sample is added 1 minute to 1 hour prior to the application of the stimulus.

17. A method as in Claims 14 to 16 wherein the test sample is added 5 minutes prior to the application of the stimulus.

18. A method as in Claims 14 to 16 wherein the test sample is added 30 minutes prior to the application of the stimulus.

19. A method of determining the presence of a toxicant in a test sample, comprising the steps of;

- exposing a eukaryote that has been transformed with a light emitting $Ca^{2+}$ regulated photoprotein gene to a test sample
- measuring the light produced by the transformed cell/organism
- determining whether the amount of light is above a defined threshold at a specified time after the time of exposure.

20. A method as in Claim 19 which comprises the step of determining whether the amount of light is below a defined threshold.

21. A method as in Claims 19 and 20 wherein the specified time after the time of exposure is 11 minutes.

22. A method as in Claims 19 to 21 wherein the eukaryote is a fungi.

23. A method as in Claim 22 wherein the fungi is a filamentous fungi.

24. A method as in Claims 22 to 23 wherein the fungi is of the Aspergillus species.

25. A method as in Claims 19 to 21 wherein the eukaryote is a mammalian cell.

26. A method as in Claims 19 to 21 wherein the eukaryote is a plant cell.

27. A method as in Claims 19 to 26 wherein the test sample comprises a toxicant.

28. A method as in Claims 19 to 27 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant gene.

29. A method as in Claims 19 to 28 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene
- obelin gene
- mnemiopsin gene
- berovin gene

30. A method as in Claims 19 to 29 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene may be a functional homologue of a gene selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene
- obelin gene
- mnemiopsin gene
- berovin gene

31. A method as in Claims 19 to 30 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is an aequorin gene.

32. A method as in Claims 31 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant aequorin gene.

33. A method as in Claims 19 to 32 wherein the light that is measured is in the form of luminescence.

34. A method as in Claims 19 to 33 wherein the test sample is added in advance of the application of a stimulus to the test sample.

35. A method as in Claim 34 wherein the stimulus is at least one or more from the group comprising; mechanical perturbation, hypo-osmotic shock, change in external calcium chloride concentration, temperature shock and pH shock.

36. A method as in Claims 34 to 35 wherein the test sample is added 1 minute to 1 hour prior to the application of the stimulus.

37. A method as in Claims 34 to 36 wherein the test sample is added 5 minutes prior to the application of the stimulus.

38. A method as in Claims 34 to 36 wherein the test sample is added 30 minutes prior to the application of the stimulus.

39. A method of determining the presence of a toxicant in a test sample, comprising the steps of;

- exposing a eukaryote that has been transformed with a light emitting $Ca^{2+}$ regulated photoprotein gene to a test sample
- measuring the light produced by the transformed cell/organism
- and comparing the light measurement data with a bank of known toxicity reference data.

40. A method as in Claim 39 wherein the method comprises the step of determining whether the amount of light is below a defined threshold.

41. A method as in Claims 39 to 40 wherein the specified time after the time of exposure is 11 minutes.

42. A method as in Claims 39 to 40 wherein the eukaryote is a fungi.

43. A method as in Claim 42 wherein the fungi is a filamentous fungi.

44. A method as in Claims 42 to 43 wherein the fungi is of the *Aspergillus* species.

45. A method as in Claims 39 to 41 wherein the eukaryote is a mammalian cell.

46. A method as in Claims 39 to 41 wherein the eukaryote is a plant cell.

47. A method as in Claims 39 to 46 wherein the test sample comprises a toxicant.

48. A method as in Claims 39 to 47 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant gene.

49. A method as in Claims 39 to 48 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene
- obelin gene
- mnemiopsin gene
- berovin gene

50. A method as in Claims 39 to 49 wherein, the light emitting $Ca^{2+}$ regulated photoprotein gene may be a functional homologue of a gene selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene

- obelin gene
- mnemiopsin gene
- berovin gene

51. A method as in Claims 39 to 50 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is an aequorin gene.

52. A method as in Claims 39 to 51 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant aequorin gene.

53. A method as in Claims 39 to 52 wherein the light that is measured is in the form of luminescence.

54. A method as in Claims 39 to 53 wherein the test sample is added in advance of the application of a stimulus to the test sample.

55. A method as in Claim 54 wherein the stimulus is at least one or more from the group comprising; mechanical perturbation, hypo-osmotic shock, change in external calcium chloride concentration, temperature shock and pH shock.

56. A method as in Claims 54 to 55 wherein the test sample is added 1 minute to 1 hour prior to the application of the stimulus.

57. A method as in Claims 54 to 56 wherein the test sample is added 5 minutes prior to the application of the stimulus.

58. A method as in Claims 54 to 55 wherein the test sample is added 30 minutes prior to the application of the stimulus.

59. A method as in Claims 39 to 58 wherein the method is used to determine the amount of toxicant in the sample.

60. A method as in Claims 39 to 59 wherein the method is used to identify the toxicant in the sample.

61. A method of determining the presence of a toxicant in a test sample, comprising the steps of;

- exposing a eukaryote that has been transformed with a light emitting $Ca^{2+}$ regulated photoprotein gene to a test sample
- measuring the light produced by the transformed cell/organism
- converting the light data into a cytosolic free calcium ion concentration trace,
- and comparing at least one parameter of the cytosolic free calcium ion concentration trace with a bank of known toxicity reference data.

62. A method as in Claim 61 wherein the method comprises the step of determining whether the amount of light is below a defined threshold.

63. A method as in Claims 61 to 62 wherein the eukaryote is a fungi.

64. A method as in Claim 63 wherein the fungi is a filamentous fungi.

65. A method as in Claims 63 to 64 wherein the fungi is of the *Aspergillus* species.

66. A method as in Claims 61 to 62 wherein the eukaryote is a mammalian cell.

67. A method as in Claims 61 to 62 wherein the eukaryote is a plant cell.

68. A method as in Claims 61 to 67 wherein the test sample comprises a toxicant.

69. A method as in Claims 61 to 68 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant gene.

70. A method as in Claims 61 to 69 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is selected from the group comprising;

- aequorin gene
- halistaurin (mitrocomin) gene
- phialidin (clytin) gene

- obelin gene
- mnemiopsin gene
- berovin gene

71. A method as in Claims 61 to 70 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene may be a functional homologue of a gene selected from the group comprising;
    - aequorin gene
    - halistaurin (mitrocomin) gene
    - phialidin (clytin) gene
    - obelin gene
    - mnemiopsin gene
    - berovin gene

72. A method as in Claims 61 to 71 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is an aequorin gene.

73. A method as in Claims 61 to 72 wherein the light emitting $Ca^{2+}$ regulated photoprotein gene is a recombinant aequorin gene.

74. A method as in Claims 61 to 73 wherein the light that is measured is in the form of luminescence.

75. A method as in Claims 61 to 74 wherein the test sample is added in advance of the application of a stimulus to the test sample.

76. A method as in Claim 75 wherein the stimulus is at least one or more from the group comprising; mechanical perturbation, hypo-osmotic shock, change in external calcium chloride concentration, temperature shock and pH shock.

77. A method as in Claims 75 to 76 wherein the test sample is added 1 minute to 1 hour prior to the application of the stimulus.

78. A method as in Claims 75 to 77 wherein the test sample is added 5 minutes prior to the application of the stimulus.

79. A method as in Claims 75 to 77 wherein the test sample is added 30 minutes prior to the application of the stimulus.

80. A method as in Claims 61 to 79 wherein light is measured for between 1 minute and 5 hours following the application of the stimulus.

81. A method as in Claims 61 to 79 wherein light is measured for between 1 minute and 96 hours following the application of the stimulus.

82. A method as in Claims 61 to 79 wherein light is measured for 5 minutes following the application of the stimulus.

83. A method as in Claims 61 to 82 wherein the cytosolic free calcium ion trace is a plot of the

cytosolic free calcium ion concentration against time.

84. A method as in Claims 61 to 83 wherein the parameter is at least one or more selected from the group comprising;

- lag time
- rise time
- absolute amplitude
- relative amplitude
- Length of transient at 20%, 50% and 80% of maximum amplitude
- number of cytosolic free calcium ion concentration increases
- percentage increase in final cytosolic free calcium ion concentration resting level
- percentage increase in recovery time
- percentage increase in pre-stimulating cytosolic free calcium ion concentration resting level
- total concentration of calcium

85. A method as in Claims 61 to 84 wherein the method is used to determine the amount of toxicant in the sample.

86. A method as in Claims 61 to 85 wherein the method is used to identify the toxicant in the sample.